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The Physicians' Practice Assessment Questionnaire on asthma and COPD

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Summary
We describe a new tool, the Physicians' Practice Assessment Questionnaire (PPAQ), designed for the global self-assessment of implementation of asthma and COPD guidelines, as determined by the percentage of patients in whom physicians estimate that they implement guidelines key recommendations. Some of its properties were assessed by a group of 47 general practitioners (GPs), and test–retest data were obtained in repeating the questionnaire at a 5-week interval without intervention in a sub-group of 28 practitioners. Answers to the various questions were globally reproducible. The lowest scores (recommendations implemented in less than 50% of their patients) were: 1) for both asthma and COPD: referral for patient education, provision of a written action plan and regular assessment of inhaler technique, 2) for asthma: referral to a specialist for difficult to control asthma or uncertain diagnosis, and 3) for COPD: assessment of lung function and disability according to specific criteria and referral to a rehabilitation program. The analysis showed sufficient internal consistency for both questionnaires (Cronbach alphas 0.7617 for asthma and 0.8317 for COPD). Pearson's correlations indicated good test–retest ($r = 0.6421$, $p = 0.0002$ for asthma; $r = 0.6801$, $p < 0.0001$ for COPD). In conclusion, the PPAQ is a new tool to assess implementation of asthma and COPD guidelines; it has the potential to identify care gaps that can be specifically targeted for intervention.

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Introduction

Asthma and Chronic Pulmonary Obstructive Disease (COPD) are the two most common pulmonary diseases in Canada, as elsewhere.[1,2] Unfortunately, these conditions are still poorly controlled in a large number of patients and therefore result in a significant human and socio-economical burden.[3–5]

Practice guidelines have been developed in the last two decades to optimize care but their recommendations are still insufficiently implemented, particularly in primary care settings.[6,7] Various methods have been proposed to assess if medical practice is in keeping with current guidelines, including self-assessment questionnaires, surveys, chart audits or patient questionnaires or outcome research.[8–10] However, to our knowledge, no specific tool has been developed to globally determine if physicians have integrated the key recommendations of current asthma and COPD guidelines recommendations into day-to-day care.

We describe the Physicians' Practice Assessment Questionnaire (PPAQ), a new physician's self-assessment questionnaire assessing the implementation of key Canadian asthma and COPD guidelines recommendations in a group of Canadian general practitioners, and report the results of the test–retest of these asthma and COPD questionnaires. This tool was developed to be used in studies led by the Canadian Respiratory Guidelines Committee of the Canadian Thoracic Society (CTS) on new strategies to help increase implementation of Canadian asthma and COPD guidelines.[11]

Methods

Characteristics of participants

Out of a total of 141 physicians invited to participate, a total of 47 primary care physicians were recruited; 28 (mean medical practice duration: 28.6 years) completed both the asthma and COPD questionnaires on 2 occasions while an additional 9 practitioners (mean medical practice duration: 21 years) completed the Asthma-PPAQ and 10, the COPD-PPAQ only once. None was previously aware of the questions to be asked.

All participating physicians were practicing Canadian primary care practitioners with general practices (i.e., not specialising in particular areas). Physicians invited to participate were recruited at random from a list of Canadian physicians who had participated in Continuing Medical Education (CME) initiatives in cardiology, urology or osteoporosis within the past 5 years. For those who completed the questionnaire twice, no specific intervention was conducted between the tests, produced at an average interval of 5 weeks of each other (test–retest). We did not formally record the characteristics of the physicians not participating in this study, but the main reason was a lack of time for participation.

Production of the PPAQ

This questionnaire was conceived by two of the authors (LPB and DO) according to the most recent Canadian guidelines[12,13] and reviewed by a panel of Canadian asthma and COPD specialists for their comments and approval.

The Asthma-PPAQ includes 14 key actions suggested by the most recent Canadian adult asthma consensus guidelines,[12] which is also in keeping with international guidelines.[14] For the analyses, the questions were separated into 2 domains (Table 1): 1) Diagnosis and Assessment (Questions 1,4,5,9–11) and 2) Treatment & Follow-up (Questions 2,3,6–8,12–14).

The COPD-PPAQ includes 12 key interventions suggested by the most recent Canadian COPD consensus guidelines.[13] For the analyses, the questions were also separated into 2 domains (Table 2): 1) Diagnosis and Assessment (Questions 1–3,11,12) and 2) Treatment & Follow-up (Questions 4–10).

For each question, the physician was asked to record the approximate percentage of his/her patients in whom he/she implemented each guideline recommendation mentioned. We then obtained a global percent score for each physician, and also determined the mean score for the whole group of practitioners for each specific question or domain.

Properties of the PPAQ

The following properties of the questionnaire were evaluated. 1) *Test–retest reliability*, the ability of the instrument to provide the same results when used repeatedly under similar conditions and which does not penalize systematic error attributed to a learning effect that is a natural phenomenon and not a defect for this procedure, 2) *internal consistency*, the extent to which different elements of the tool are measuring the same construct, determined using Cronbach's alpha statistics, and 3) *intraclass reliability*, the ability of the instrument to provide the same results when used repeatedly under similar conditions, taking into account the number of systematic errors. *Cross-sectional construct validity* was not evaluated as there are, to our knowledge, no corresponding evaluation tools to globally assess guidelines implementation of these key recommendations.

Statistical analysis

This study mostly evaluates "face validity" of the questionnaire. Values are reported as mean $\pm$ SD. Pearson's product–moment correlation was performed to assess test–retest reliability. The intraclass correlation (ICC) was used to assess intrarater reliability. The Student's paired *t*-test was performed to compare mean values between 1st and 2nd questionnaire. The Cronbach's coefficient alpha estimates were used to determine the internal consistency of the questionnaires. The results were considered significant with *p*-values ≤ 0.05. The data were analyzed using the statistical package program SAS v9.2 (SAS Institute Inc., Cary, NC).

Results

Mean scores

Mean scores for each question were quite different from one item to another. Low scores (recommendation

Table 1 Asthma Physician Practice Assessment Questionnaire (Asthma-PPAQ)©.

For what percent of your asthma patients do you currently…		
1	Confirm diagnosis by pulmonary function tests (either spirometry and bronchodilator reversibility or bronchoprovocation)	_____%
2	Provide written referral for asthma education	_____%
3	Provide a written action plan for exacerbation management	_____%
4	Assess inhaler technique (or refer to asthma educator) at each visit	_____%
5	Identify environmental triggers/inducers	_____%
6	Provide smoking cessation counseling and/or recommend cessation measures	_____%
7	Prescribe an inhaled corticosteroid (ICS) as initial maintenance therapy	_____%
8	Prescribe an inhaled ICS and a long-acting beta$_2$-agonist (LABA) when asthma is not controlled by ICS low dose alone	_____%
9	Check for treatment adherence at each visit	_____%
10	Use the Canadian Thoracic Society (CTS) control criteria or the Global Initiative for Asthma (GINA) guidelines to assess patient's asthma control	_____%
11	Address patients' concerns about disease/treatment	_____%
12	Refer to a specialist because asthma is difficult to control	_____%
13	Refer to a specialist if the asthma diagnosis is uncertain	_____%
14	Schedule regular follow-up appointments	_____%

implemented in less than 50% of patients) were observed both for asthma (Table 3) and COPD (Table 4) in regard to referral for patient education, provision of a written action plan for the management of exacerbations and regular assessment of inhaler technique. Furthermore, for asthma, referral to a specialist for difficult to control asthma or uncertain diagnosis was infrequently implemented. This was also the case for assessment of functional status and disability according to specific Medical Research Council criteria, as suggested in Canadian guidelines, and referral to a rehabilitation program.

Test–retest assessment

Answers to the various questions were globally reproducible although looking at the "test–retest reliability", better scores were noted on the second test as indicated by statistically significant differences for many items of both questionnaires – however these changes were small (Tables 3 and 4).

Test–retest reliability

Pearson's correlations indicated good test–retest reliability of both the Asthma-PPAQ ($r = 0.6421$, $p = 0.0002$) and the COPD-PPAQ ($r = 0.6801$, $p \leq 0.0001$) (Tables 3 and 4, Figs. 1 and 2). For questions related 1) to diagnosis and assessment, and 2) to treatment, Pearson's correlations indicated good tests–retest reliability of both the Asthma-PPAQ ($r = 0.5781$, $p = 0.0013$ and $r = 0.6500$, $p = 0.0002$, respectively) and COPD-PPAQ ($r = 0.6418$, $p = 0.0002$ and $r = 0.6944$, $p \leq 0.0001$, respectively).

Intrarater reliability

The ICC indicated good intrarater reliability of both the Asthma-PPAQ ($r = 0.6184$, $p \leq 0.0001$) and the COPD-PPAQ

Table 2 COPD Physician Practice Assessment Questionnaire (COPD-PPAQ)©.

For what percent of your COPD patients do you currently…		
1	Confirm diagnosis by pulmonary function tests (i.e., spirometry after bronchodilator with or without lung volumes)	_____%
2	Assess level of function & disability (with Modified Medical Research Council (MRC) scale)	_____%
3	Document frequency and severity of COPD exacerbations	_____%
4	Prescribe at least one long-acting bronchodilator if MRC >3 (where MRC 3 is described as 'walking slower than people of the same age on the level or stopping for breath while walking at your own pace on the level')	_____%
5	Prescribe inhaled corticosteroid (ICS) + long-acting beta$_2$-agonist (LABA) in combination and tiotropium if MRC >3 + exacerbations (>1/year)	_____%
6	Provide an exercise prescription to promote regular physical activity	_____%
7	Refer to pulmonary rehabilitation program if >MRC 3	_____%
8	Provide written referral for structured patient education	_____%
9	Provide a written action plan for exacerbation management	_____%
10	Provide smoking cessation counseling and pharmacological intervention if smoking	_____%
11	Assess inhaler/device technique (or refer to COPD educator) at each visit	_____%
12	Refer to specialist if diagnosis is uncertain, if clinical deterioration is rapid or if home oxygen or surgical options are being considered	_____%

Table 3 Test–retest and intrarater reliability from Physicians' Practice Assessment Questionnaire.

Asthma Questionnaire						
	Physicians' Practice Assessment Questionnaire		Test–retest reliability		Intrarater reliability	
	1st Questionnaire	2nd Questionnaire	ρ	p-Value	ρ	p-Value
Question #1	50.9 ± 31.3	60.5 ± 30.1	0.7882	<0.0001	0.7948	<0.0001
Question #2	33.8 ± 26.2	32.2 ± 28.4	0.6191	<0.0001	0.6309	<0.0001
Question #3	29.3 ± 27.1	34.2 ± 26.8	0.6819	<0.0001	0.6963	<0.0001
Question #4	28.9 ± 31.3	31.6 ± 29.0	0.5899	0.0010	0.6022	0.0003
Question #5	50.0 ± 29.1	57.7 ± 23.6	0.5234	0.0043	0.4874	0.0045
Question #6	87.3 ± 21.0	91.4 ± 17.4	0.2086	0.2868	0.2236	0.1326
Question #7	73.0 ± 27.9	81.2 ± 19.6	0.5348	0.0049	0.5155	0.0026
Question #8	82.5 ± 22.2	85.2 ± 22.7	−0.0557	0.7705	0	1.0000
Question #9	72.9 ± 22.6	77.0 ± 20.7	0.4887	0.0083	0.4893	0.0044
Question #10	63.2 ± 33.1	65.7 ± 27.4	0.4644	0.0128	0.4228	0.0136
Question #11	77.0 ± 25.3	80.0 ± 18.2	0.5040	0.0062	0.4187	0.0144
Question #12	40.3 ± 39.0	43.8 ± 37.5	0.5031	0.0075	0.5194	0.0024
Question #13	49.0 ± 40.8	48.1 ± 37.0	0.5726	0.0018	0.5838	0.0005
Question #14	62.5 ± 34.8	62.5 ± 33.7	0.7179	<0.0001	0.7114	<0.0001
Q1–Q14 Mean	**57.2 ± 14.6**	**60.7 ± 11.0**	**0.6421**	**0.0002**	**0.6184**	**0.0002**
Dx	**57.1 ± 18.6**	**62.1 ± 12.6**	**0.5781**	**0.0013**	**0.5422**	**0.0015**
Rx	**57.4 ± 15.8**	**59.7 ± 14.3**	**0.6500**	**0.0002**	**0.6495**	**<0.0001**

Questions related to diagnosis and assessment Dx:1,4,5,9–11.
Questions related to treatment Rx:2,3,6–8,12–14.

($r = 0.6771$, $p \leq 0.0001$) (Tables 3 and 4, Figs. 1 and 2). For questions related to diagnosis and assessment and to treatment, the ICC indicated good intrarater reliability for both Asthma-PPAQ ($r = 0.5422$, $p = 0.0015$ and $r = 0.6495$, $p \leq 0.0001$, respectively) and COPD-PPAQ ($r = 0.6529$, $p \leq 0.0001$ and $r = 0.6851$, $p \leq 0.0001$, respectively).

Internal consistency

Cronbach's alpha coefficient indicated good internal consistency for both the Asthma-PPAQ (0.7617) and the COPD-PPAQ (0.8317). For questions related to diagnosis and assessment and to treatment, Cronbach's alpha coefficient indicated good internal consistency for Asthma-PPAQ

Table 4 Test–retest and intrarater reliability from Physicians' Practice Assessment Questionnaire.

COPD Questionnaire						
	Physicians' Practice Assessment Questionnaire		Test–retest reliability		Intrarater reliability	
	1st Questionnaire	2nd Questionnaire	ρ	p-Value	ρ	p-Value
Question #1	71.1 ± 32.2	74.8 ± 28.0	0.8039	<0.0001	0.7676	<0.0001
Question #2	42.0 ± 36.9	44.6 ± 34.9	0.6213	0.0004	0.6164	0.0002
Question #3	58.6 ± 30.9	62.9 ± 27.8	0.4705	0.0115	0.4308	0.0120
Question #4	70.0 ± 28.6	75.7 ± 21.2	0.3259	0.0972	0.3321	0.0491
Question #5	69.3 ± 30.4	80.2 ± 18.1	0.6607	0.0002	0.5264	0.0021
Question #6	55.0 ± 34.9	63.4 ± 32.0	0.4802	0.0097	0.4903	0.0043
Question #7	34.0 ± 30.8	36.4 ± 24.9	0.7719	<0.0001	0.7573	<0.0001
Question #8	18.6 ± 22.1	27.0 ± 24.0	0.5452	0.0027	0.5605	0.0010
Question #9	32.5 ± 33.1	34.5 ± 27.6	0.6837	<0.0001	0.6870	<0.0001
Question #10	93.8 ± 14.7	91.4 ± 15.4	0.0491	0.8039	0.0864	0.3357
Question #11	29.8 ± 32.0	39.8 ± 30.1	0.7869	<0.0001	0.7925	<0.0001
Question #12	65.4 ± 38.1	53.5 ± 36.1	0.4555	0.0170	0.4589	0.0076
Q1–Q12 Mean	**53.0±18.7**	**57.0±15.0**	**0.6801**	**<0.0001**	**0.6771**	**<0.0001**
Dx	**53.4±21.2**	**55.0±19.8**	**0.6418**	**0.0002**	**0.6529**	**<0.0001**
Rx	**52.8±19.0**	**58.4±14.6**	**0.6944**	**<0.0001**	**0.6851**	**<0.0001**

Questions related to diagnosis and assessment Dx:1–3,11,12. Item 12 includes a treatment component but has been mainly considered an assessment item.
*Questions related to treatment Rx:4–10.

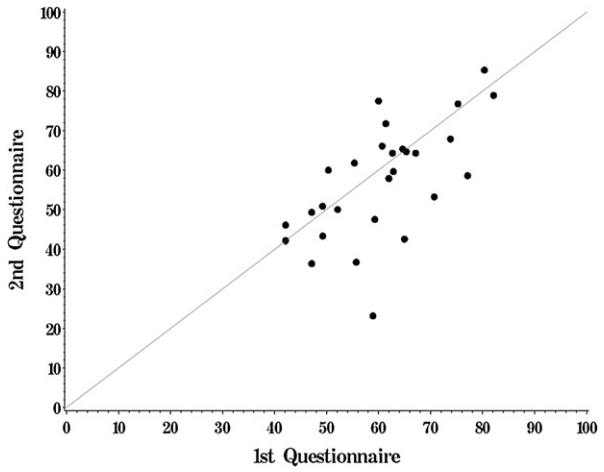

Figure 1 Test—retest % scores for asthma questionnaire.

(0.7145 and 0.6172 respectively) and COPD-PPAQ (0.5988 and 0.7808 respectively).

Relationships between scores for COPD vs asthma

In regard to categorical scores for COPD vs asthma, those related to treatment were poorly correlated (R: 0.21) while the mean score for items related to diagnosis was more consistent (R: 0.72). For global COPD vs asthma score, it was intermediate (R: 0.56).

Discussion

Despite the recent decades' progress in the understanding and treatment of asthma and COPD, these conditions are still associated with a high morbidity and health-care use.[3—5] Numerous national and international guidelines have been developed in the last decades to improve the management of these diseases but their implementation into care is still deficient. There is, however, a need to develop better knowledge transfer strategies and assess if they are effective.

The CTS Canadian Respiratory Guidelines Committee recently reorganised its respiratory guidelines production, dissemination, implementation and assessment of their effectiveness to improve respiratory care.[11] This group also aimed at developing new tools to assess how physicians implement current practice guidelines.

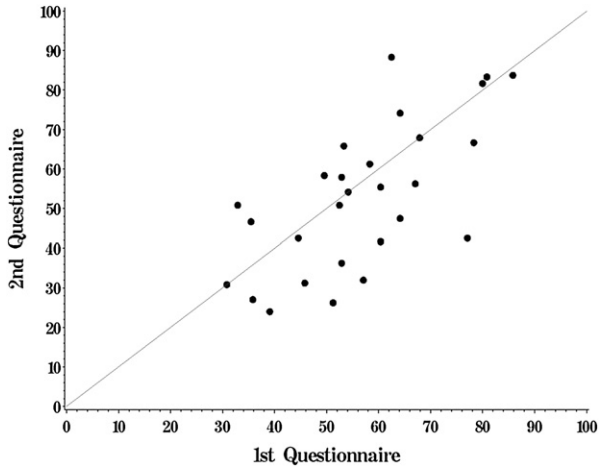

Figure 2 Test—retest % scores for COPD questionnaire.

Previous studies on the efficacy of CME programs included as outcomes, selected physicians' behaviours or patient-related outcomes, but there is still a need to develop instruments that would globally assess how physicians report implementing the main recommendations of current guidelines.[8] The present tool uses a consensually selected number of key recommendations from the last Canadian asthma and COPD guidelines for which physicians estimated the percentage of patients in whom they follow such recommendation. The study showed that this tool globally provides reproducible values, the changes observed being very small and unlikely to be clinically significant. The differences between the two assessments were more marked in the COPD patients' assessment and it would be of interest to further explore why there were such differences compared to the asthma questionnaire. Furthermore, a next step will also be to evaluate how an effective intervention could improve current care using this questionnaire.[8,15,16]

In regard to weaknesses of our study, self-report by physicians may not always correspond to reality and it will certainly be useful in the future to validate those results in a subset of physicians using chart audits. This last method however also has some weaknesses, as physicians do not always record their actions following patient encounters.[17,18] In regard to the relatively short time interval between the two questionnaires, we cannot exclude the possibility of overestimating the reproducibility of the questionnaire due to a memory effect, although it is unlikely. Furthermore, as stated above, we need to evaluate more adequately responsiveness to change of the global PPAQ score and a next step will be to evaluate how an effective intervention could improve current care, when assessed with this questionnaire.[8,15,16] Hopefully, this questionnaire may eventually become a useful instrument to assess how effective are the interventions aiming to change the clinician's behaviour. Finally, we recognize that some of the criteria tested in the COPD questionnaire are not necessarily in keeping with other guidelines, but as mentioned previously, the goal of this study was to look at the implementation of the Canadian guidelines. We encourage other guideline developers who wish to evaluate success of implementation of selected key management recommendations (which may vary slightly from country to country) to modify the physician assessment questionnaires accordingly.

In regard to the various domains evaluated by the PPAQs, the analysis suggests that both PPAQs may be useful questionnaires, with interesting properties. In this regard, they both indicate good internal consistency, test—retest reliability and intrarater reliability. This suggests that the PPAQs can contribute to the evaluation of current practice and its conformity to guidelines, but likely could be useful to assess if an intervention improves uptake of the chosen recommendations and translation into current practice. Furthermore, it is possible that if repeated over time, this questionnaire may act as a guide and incentive for the physician to develop means to improve his/her practice.

We therefore think that such instrument may be of interest both as an assessment and self-examination of implementation of current guidelines recommendations by physicians. From such questionnaire, interventions to fill the care gaps between current and what is considered optimal care could be better targeted. It will be interesting in the future to compare the performance of various caregivers including pneumologists, allergists, pediatricians and general practitioners in regard to such questionnaires.

In regard to the discrepancies observed in current practice, compared to the current guidelines, they are in keeping with those previously reported.[6,19,20] Some are common to both asthma and COPD, such as referral for patient education, provision of a written action plan and regular assessment of inhaler technique. We previously showed that objective measures to confirm the diagnosis of asthma are particularly neglected and probably explain the observed overdiagnosis of asthma, in addition to sometimes inadequate assessment of asthma control.[19,21] With respect to COPD our results are consistent with those of Bourbeau et al. who reported discrepancies between recommended treatment and current care in regard to pharmacological treatment and spirometric confirmation of diagnosis, but particularly referral for pulmonary rehabilitation.[20]

In conclusion, we describe a new physician's self-assessment tool for the global assessment of Asthma and COPD guidelines implementation and provide an evaluation of its properties. Such instruments are needed to better assess current practice and the effects of the often demanding and costly interventions provided to improve chronic diseases care. The PPAQ properties suggest that it is a valid and potentially useful tool in this regard.

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LP Boulet:
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References

1. Canadian Institute for Health Information, Canadian Lung Association, Health Canada, Statistics Canada. *Respiratory disease in Canada*. 1st ed. Ottawa: Health Canada; 2001. p. 1—102.
2. Bousquet J, Dahl R, Khaltaev N. Global alliance against chronic respiratory diseases. *Eur Respir J* 2007;**29**:233—9.
3. Chapman KR, Ernst P, Grenville A, Dewland P, Zimmerman S. Control of asthma in Canada: failure to achieve guideline targets. *Can Respir J* 2001 March;**8**(Suppl. A):35A—40A.
4. Godtfredsen NS, Lam TH, Hansel TT, Leon ME, Gray N, Dresler C, et al. COPD-related morbidity and mortality after smoking cessation: status of the evidence. *Eur Respir J* 2008; **32**:844—53.
5. Fournier M, Tonnel AB, Housset B, et al. SCOPE. Economic burden of COPD: the SCOPE study. *Rev Mal Respir* 2005;**22**: 247—55.
6. Boulet LP, Becker A, Bowie D, et al. Implementing practice guidelines: a workshop on guidelines dissemination and implementation with a focus on asthma and COPD. *Can Respir J* 2006;**13**(Suppl. A):5—47.
7. Jin R, Choi BC, Chan BT, et al. Physician asthma management practices in Canada. *Can Respir J* 2000;**7**:456—65.
8. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *Lancet* 2003;**362**:1225—30.
9. Davis D. Clinical practice guidelines and the translation of knowledge: the science of continuing medical education. *CMAJ* 2000;**163**:1278—9.
10. Gross PA, Greenfield S, Cretin S, et al. Optimal methods for guideline implementation: conclusions from Leeds Castle meeting. *Med Care* 2001;**39**:II85—92.
11. Boulet LP, McIvor RA, Marciniuk D, Canadian Thoracic Society Respiratory Guidelines Committee. Respiratory guidelines implementation in Canada. *Can Respir J* 2007;**14**:329—30.
12. Lemière C, Bai T, Balter M, et al on behalf of the Canadian Adult Consensus Group of the Canadian Thoracic Society. Adult asthma consensus guidelines update 2003. *Can Respir J* 2004 May;**11**(Suppl. A):9A—18A.
13. O'Donnell D, Hernandez P, Kaplan A, et al. Canadian Thoracic Society recommendations for management of chronic obstructive pulmonary disease — 2008 update — highlights for primary care. *Can Respir J* 2008;**15**(Suppl. A):1A—8A.

14. Bateman ED, Hurd SS, Barnes PJ, et al. Global strategy for asthma management and prevention: GINA executive summary. *Eur Respir J* 2008;**31**:143—78.
15. Davis DA, Thomson MA, Oxman AD, Haynes RB. Changing physician performance. A systematic review of the effect of continuing medical education strategies. *JAMA* 1995;**274**:700—5.
16. Boulet LP. Improving knowledge transfer on chronic respiratory diseases: a Canadian perspective. How to translate recent advances in respiratory diseases into day-to-day care. *J Nutr Health Aging* 2008;**12**:758s—63s.
17. Grimshaw JM, Thomas RE, MacLennan G, et al. Effectiveness and efficiency of guideline dissemination and implementation strategies. *Health Technol Assess (Winchester, England)* 2004; **8** [iii—iiv].
18. Jamtvedt G, Young JM, Kristoffersen DT, Thomson O'Brien MA, Oxman AD. Audit and feedback: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev*; 2003.
19. Jin R, Choi BC, Chan BT, McRae L, Li F, Cicutto L, Boulet LP, Mitchell I, Beveridge R, Leith E. Physician asthma management practices in Canada. *Can Respir J* 2000;**7**:456—65.
20. Bourbeau J, Sebaldt RJ, Day A, Bouchard J, Kaplan A, Hernandez P, Rouleau M, Petrie A, Foster G, Thabane L, Haddon J, Scalera A. Practice patterns in the management of chronic obstructive pulmonary disease in primary practice: the CAGE study. *Can Respir J* 2008;**15**:13—9.
21. Aaron SD, Vandemheen KL, Boulet LP, McIvor RA, Fitzgerald JM, Hernandez P, Lemiere C, Sharma S, Field SK, Alvarez GG, Dales RE, Doucette S, Fergusson D, Canadian respiratory Clinical research Consortium. Overdiagnosis of asthma in obese and nonobese adults. *CMAJ* 2008;**179**: 1121—31.